

# THE REVIEW

DEVOTED TO THE INTERESTS OF THE AMERICAN SOCIETY FOR METALS

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No. 2

## California Beckons to Congress Visitors March 21

### Continuous Mill Contrasted to Older Practice

**Improved and Larger Sheets Produced in Greater Tonnage Than by Sheet Bar Method**

Muncie Chapter—"The Production and Testing of Deep Drawing Sheets," was the subject of a talk presented in New Castle, Ind., on Jan. 13. R. L. Kenyon, research metallurgist of The American Rolling Mill Co., Middletown, Ohio, was the speaker and at the conclusion of his talk showed a moving picture which illustrated present-day methods of producing deep drawing sheets on the Armeo continuous rolling mill.

Mr. Kenyon introduced his remarks with an explanation of the differences between the older "sheet bar" method and the new continuous mill practice for producing high quality sheets for deep drawing purposes. It was pointed out that the new method has not only made greater tonnages possible, but has permitted the manufacture of much larger sheets than before, as well as sheets of improved surface and better drawing properties.

#### High Finish Required

The utilization of such large high finish sheets was illustrated with various automobile body stampings.

The properties necessary for sheets for deep drawing were discussed and the methods of testing were covered in considerable detail. Sheets must have not only sufficient strength and ductility but a suitable surface which will take present-day lacquers and surface finishes.

The mechanism of plastic deformation and the effect of grain size on the physical properties and surface condition were mentioned.

Various hardness tests, as well as cupping tests and folding and bending tests, were described and the speaker showed the place they have in the rou-

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### Machining Talk and Movie Combine in Good Program

By C. B. Brodie

Schenectady Chapter—Clyde Llewellyn, metallurgist for Bliss & Laughlin, Inc., was the speaker at the meeting held Jan. 18 at the Van Curler Hotel.

The first part of the program included an excellent motion picture showing the major operations involved in the making, rolling, and finishing of bar steels at Bliss & Laughlin.

This was followed by a talk entitled, "Metals to be Machined." The complexity of machinability was thoroughly dealt with. The effect of chemical composition, grain size and Brinell hardness, as well as the effect of hot rolling, cold drawing, and structures developed during annealing were discussed.

Mr. Llewellyn's movie and talk were considered by those present to be one of the most interesting programs held by the Chapter.

### Los Angeles' Biltmore Is Host Hotel



*Surrounded by Palms and Other Tropical Vegetation, the Beautiful Biltmore Hotel Is Headquarters for the Western Metal Congress and Exposition, to Be Held the Week of March 21 to 25 in Los Angeles*

### Personal Experience Livens Waterhouse's Tool Steel History

By George E. Stoll

Notre Dame Chapter—Pleasing the audience both by his pleasant and convincing manner of speaking, and by the interesting nature of his address, National President George B. Waterhouse of Massachusetts Institute of Technology visited the chapter on Jan. 12.

After an opening discussion about the past, present and future of the Society, Dr. Waterhouse began a most interesting history of the development of tool steels. His wide knowledge enabled him to trace vividly the progress from the early Huntsman process up to present methods.

The address sparkled with his personal experiences as a youth in Sheffield, and the crucible process and the making of the crucibles were described in detail.

The advantages and limitations of the open-hearth, direct arc, induction, and crucible processes of modern times were explained. Each of these methods will yield good tool steel if care is exercised in the selection of the charge and the operation of the furnace.

Ingots size, selection and development were considered as well as the absolute necessity of removing all surface imperfections before the merchant bar is worked into tools. Surface imperfections are magnified by further work and will result in a faulty piece of steel.

After the lecture Dr. Waterhouse answered questions from the audience that ran the gamut from the early swords of Damascus to the high speed steels of today.

The attendance was the largest of the year and numbered 120 members and friends.

### All-Expense Tour to Congress

A four-week, all-expense, conducted tour to California with sightseeing stops both on the way out by train and on the return trip by boat has been specially arranged for the benefit of those who plan to attend the Western Metal Congress in Los Angeles—the week of March 21.

Complete information concerning itinerary and rates, which are remarkably low, can be secured from the American Society of Mechanical Engineers, 29 W. 39th St., New York.

### Welding Eight Classes of Copper Alloys Discussed

By J. Arthur Reese

Baltimore Chapter—At the December meeting Ira T. Hook, research engineer, American Brass Co., Waterbury, Conn., delivered an enlightening lecture on "Non-Ferrous Metals."

In the forepart of his address, Mr. Hook discussed the eight groups of copper alloys and the 11 alloying elements which may be present in these metals.

The greater part of his lecture concerned the welding of the copper-base metals with explanatory remarks as to the effect of the alloying elements in the copper, brasses and bronzes.

Mr. Hook also described the advantages and disadvantages of the several welding procedures with the different weld materials for each type of alloy.

The excellent attendance and lively discussion which followed Mr. Hook's presentation displayed the interest shown in this subject. A rather complete summary of the lecture is being published in a current issue of the *Baltimore Engineer*, monthly publication of the Engineers Club.

### Thousands Will Come to Coast For Exposition

**Theme of Western Metal Congress Technical Sessions Will Be Metals in Industry**

Based on the theme, "Metals in Industry," the Western Metal Congress and Exposition, to be held March 21 to 25 in the Pan-Pacific Auditorium and Biltmore Hotel, Los Angeles, is expected to attract 3000 executives, plant operators, metallurgists and superintendents to the Congress and many more thousands to the Exposition.

According to A.S.M. Secretary Eisenman, an earnest effort will be made to eliminate curiosity seekers and to attract only interested men who are definitely connected with the fabrication of industrial metals.

#### 18 Societies Cooperating

Eighteen national technical societies are cooperating in the Congress and Exposition. These are:

American Chemical Society, American Foundrymen's Association, American Institute of Aeronautical Engineers, American Institute of Electrical Engineers, American Institute of Mining and Metallurgical Engineers (Institute of Metals), American Petroleum Institute (California Division), American Society of Civil Engineers, American Society of Mechanical Engineers, American Society for Testing Materials, American Welding Society, Chamber of Mines and Oils, Metal Trades and Manufacturers' Association, Mining Association of the Southwest, National Purchasing Agents' Association, Pacific Coast Electrical Association, Pacific Coast Gas Association, Society of Automotive Engineers and the American Society for Metals.

#### To Have Special Sessions

The American Welding Society, American Society of Mechanical Engineers and the Pacific Coast Gas Association will meet independently in their own sessions during the week of the Congress and Exposition.

Particular attention will be paid in the technical sessions to metals used in

(Continued on page 5)

### Columbus Course Popular

By D. E. Krause

The first of a series of six lectures in the Columbus Chapter educational course based on M. A. Grossmann's "Principles of Heat Treatment" was given by M. L. Samuels of Battelle Memorial Institute on Jan. 17.

The popularity of the course exceeded all expectations and the first meeting was attended by over 100 members of which approximately 50 were new members.

Other speakers at the weekly meetings were S. Z. Krumm, Buckeye Steel Castings Co., A. L. Sanford, Battelle Memorial Institute, J. C. Dorn, Battelle Memorial Institute, George N. Moffat, Ohio State University, and R. E. Christian, Columbus Bolt Works Co.

## THE REVIEW

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7016 Euclid Ave., Cleveland, O.

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RAY T. BAYLESS.....Editor  
M. R. HYSLOP.....Managing Editor

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## Use of Oxy-Acetylene Flame Is Tid-Bit of Talk on Hardening

By M. J. Donachie

Springfield Chapter's December meeting was one of the liveliest in local records. The talk on "Surface Hardening and Carburizing" by A. B. Kinzel of Union Carbide and Carbon Research Laboratories, was highly instructive and entertaining.

The various packs and baths used to produce surface hardness were surveyed, showing the manner in which the active hardening agent reacts with the metal to produce the necessary case. The theoretical aspect of the attending mechanism was discussed without detracting from the practical viewpoint.

The tid-bit of the evening was the speaker's presentation of the oxy-acetylene flame as a tool for the production of hard surfaces. The applicability of the torch to a wide range of shapes and sizes and the diverse field of usefulness prompted interest to excitement.

A number of slides graphically portrayed the remarkable control of case depth and hardness, and the various nozzles and burner tips and accessories required for control of the flame.

In a colored motion picture (talkies) the torch was shown in action and the versatility of the tool in performing most intricate jobs was beautifully illustrated.

In the discussion Dr. Kinzel was literally bombarded with questions—evidence of the interest that flame hardening had aroused.

## Hartford Has Talk and Movie on Cold Finishing

By R. J. Haigis

Hartford Chapter—On Jan. 11 approximately 200 members and guests gathered at the Hartford Electric Light Co. auditorium to hear a talk on "Cold Finished Steel" by Thomas D. Taylor, chief metallurgist of Bliss and Laughlin, Inc., Buffalo, N. Y.

Mr. Taylor preceded his talk with a moving picture showing all the steps in the making of cold-drawn steel from the iron ore to the finished cold-drawn bar. Following the moving picture, Mr. Taylor presented a well-prepared and orderly paper on the industrial applications of cold-drawn steel.

A detailed report of Mr. Taylor's talk, as presented by other chapters of the Society earlier in the season, has already been presented in THE REVIEW.

## Waterhouse Covers Imposing List of Metal Developments

By Walter M. Saunders, Jr.

Rhode Island Chapter—As a most striking development in steel plants, National President George B. Waterhouse, speaking at the Dec. 1st meeting, described in considerable detail the blast furnaces and mills at Corby, England. His subject was "Recent Metallurgical Developments, Here and Abroad."

Based on the experience of this company, Stewart & Lloyds, Dr. Waterhouse feels that our iron ore reserves will last for a very long time. This company now produces pig iron the cheapest of any place in the world except India, using iron ores of only 32 to 37% iron.

At Corby, their success can be attributed largely to American initiative, according to Dr. Waterhouse, which seems somewhat surprising considering the English reputation for steel making.

### Continuous Mills Described

Among many developments described, Dr. Waterhouse mentioned improvements in melting of cast iron and steel; the part of alloys in cast iron; bessemer converter and open-hearth duplexing; Venturi type of open-hearth; and controlled atmospheres, or vacuum, in induction furnaces. Improvements in rolling mills, and soaking pits with controlled atmospheres and temperatures, were included.

Finally, Dr. Waterhouse told of the new continuous wide strip mills, which can roll strip up to 98 in. in width; the improved driving mechanism in a wire mill, where all motors are in pits, or rooms, below the main floor; and advances in electrogalvanizing.

To cover such an imposing list of developments in the short space of an evening meeting is not within the ability of many men, but Dr. Waterhouse seems to have that rare faculty of making a few words tell a complete story.

**Hamlet Stumped on Dunking Tool Steel; Palmer Gives Modern Answer**

By W. F. Morton

Rochester Chapter—"When to dunk, and how to dunk—that is the question. Whether 'tis better to heat slowly and quench interruptedly, or to take arms against a sea of troubles and by doing the opposite, end them. To scale, to warp—to warp perchance to crack, Ah! there's the rub. For when the tool is cold what nightmares we may have must make us pause. Thus tool steel doth make cowards of us all and the pale hue of resolution is sickled o'er."

Had Hamlet been a heat treater he might have soliloquized thus. But had he lived in the present age he would have heated the tool quickly and quenched it quickly. Such was the advice given the Rochester Chapter to warp—to warp perchance to crack, Ah! there's the rub. For when the tool is cold what nightmares we may have must make us pause. Thus tool steel doth make cowards of us all and the pale hue of resolution is sickled o'er."

While such advice might possibly have been considered suicidal in the old days, generally speaking it is to be recommended with modern tool steels. Oil hardening tool steels especially are definitely less subject to cracking, distortion and growth when so treated. This rather broad statement is based upon the record of two years actual experience with all kinds of tools heat treated in this manner.

Another heat treating concept attacked by the speaker was the idea that a wide difference of temperature exists between the outside and the center of a piece of steel being heated. The conclusion drawn from tests on 3-in. rounds

## To House Exposition



The Pan-Pacific Auditorium in Los Angeles Is the Modern and Beautiful Location of the Western Metal Exposition to Be Held in Conjunction With the Western Metal Congress in Los Angeles March 21 to 25. This auditorium has over 100,000 sq. ft. of floor space on one level and will thus provide unexcelled facilities for the attractive and artistic display of products by the 100-odd exhibiting firms

## Rustless Handbook Issued

A 60-page handbook on rustless and stainless steels has just been issued by Rustless Iron and Steel Corp.

Beautifully printed and illustrated, it is divided into four sections—introductory, an alloy data section containing information on 16 types of stainless steels, a section on general processing of these alloys, and an engineering data section containing ten tables of invaluable engineering information.

Copies of the handbook may be obtained free of charge by addressing Rustless Iron and Steel Corp., 1001 Edison Highway, Baltimore, Md.

6 in. long heated in a furnace maintained at 1450° F. is that when the outside is up to temperature the center is also up.

Several factors govern the production of modern tool steels, the most important of which are the chemical analysis, the inherent soundness, and the timbre or personality factor. The inherent soundness is best revealed by the hot acid etch test, while Shepherd's Penetration-Fracture test is believed to be the most scientific measurement of the personality factor.

Mr. Palmer dwelt at length on the relationship of design, tool making, tool steel selection and heat treatment, and showed that this relationship is a matter of extreme importance. To illustrate this point graphically he assigned arbitrary values of 10 to each factor, and proved that these values should be multiplied rather than added in order to get a real numerical approximation of the resulting tool.

A perfectly designed tool made of a steel ideally suited to the job and perfectly heat treated would have a value of 10,000 not 40. A perfectly designed tool made of a steel ideally suited to the job that was cracked in heat treatment would have a value of zero not 30.

The average tool is far from having a numerical value of 10,000, the actual average value being conservatively placed at less than 5,000. By making use of available knowledge in design, tool selection and heat treatment this value could be considerably increased.

## Arc Welding Preceded Gas History Shows

New "Union-Melt" Process Explained in Talk on Modern Metallic-Arc Welding

By Gordon Sproule

Montreal Chapter—"Modern Arc Welding" was the subject of the paper presented at the December meeting by David Boyd, welding engineer, Canadian Car & Foundry Co., Ltd., Montreal.

In a brief historical introduction, Mr. Boyd told how the first departure from hammer welding was the use of the carbon arc. This was followed by thermite welding, metallic-arc, resistance welding and gas welding in order.

Gas welding, however, was perfected first on account of the simplicity of the equipment and the greater ease of controlling quality of the deposited metal. With the development of suitable electrical machinery and filler rods, the metallic-arc process has outstripped the gas process. Now each process has a field in which it is pre-eminent.

For the metallic-arc process, the ideal equipment is a single-operator d.c. generator that gives 60 volts on open circuit and 300 amperes at 30 volts after the arc is struck. While a.c. equipment cannot be used with bare rods, and an open circuit voltage of 110 to 120 volts is distinctly dangerous to life, equipment for supplying a.c. power is lower in first cost and maintenance, and the absence of magnetic blow in the arc makes its manipulation easier.

### Resistance Welding Grows

Referring to design, Mr. Boyd said that butt welds can be counted on for 80 to 90% efficiency. Fillet welds are rated at 2000 psi. for a 1/4-in. fillet, 3000 psi. for a 3/8-in. fillet, and 4000 psi. for a 1/2-in. fillet.

Resistance welding has paralleled metallic-arc welding in the magnitude and diversity of its applications. In the "shotwelding" process, by controlling the rapidly repeated rushes of power within a fraction of a cycle, thin stainless steel sheet may be "sewed" together without heating the surface sufficiently to interfere with corrosion resistance.

The newest thing in welding is the metallic-arc "Union-Melt" process, developed by Union Carbide and Carbon Research Laboratories. Here again control of the power and speed are the features. Union-melt is a method of butt welding using arc currents up to 2000 or 3000 amperes and filling a heavy butt-weld groove in one pass; the arc is completely smothered in flux; results are excellent.

### Ship Welds Hold

Mr. Boyd showed lantern slides of typical applications. Most engineers have heard of the German all-welded "pocket" battleships, and others such as have been in collision or wreck have failed in the plates rather than the welds. Bridges and buildings are being all-welded, 11 of the latter having been put up in Montreal. In the fabrication of heavy pressure vessels also metallic-arc welding is pre-eminent.

Mr. Boyd showed that other processes than arc welding also have fields in which they excel. In the case of pipeline work, gas welding is the standard method.

### Address Corrected

An error was made in the list of addresses of chapter secretaries in the January issue of THE REVIEW. The correct address of C. J. Umlauf, secretary-treasurer of the Hartford Chapter, is 20 Belmont St., Wethersfield, Conn.

## Care Taken in All Phases Of Manufacture Is Feature Distinguishing Tool Steels

By Wm. G. Slack

Syracuse Chapter—In a talk on Tool Steels, given Dec. 14, M. W. Dalrymple, metallurgical supervisor of the Bethlehem Steel Co., Bethlehem, Pa., explained that tool steels are distinguished for the care taken in their manufacture.

The melts are smaller and are cast into smaller ingots than structural steels. The ingots are generally hammered into billets which are then ground all over. Finishing to size is usually accomplished by hammering or hand rolling. The careful inspection which is carried on throughout the processing and after finishing assures a product which is free from the common defects.

The speaker explained with the help of slides the various classifications under which the tool steels fall.

Of particular interest was Mr. Dalrymple's discussion of impact values. He showed the apparent discrepancy which exists between torsion impact values and Izod or Charpy values.

Size changes in various grades of water hardening and oil hardening steels were also discussed.

Mr. Dalrymple was prompt with his answers in the discussion which followed the meeting and showed a thorough knowledge of his subject.

## Calumet and Chicago Hear President at Gala Joint Meeting

By C. E. Chapman

Chicago-Calumet Chapters—A record crowd attended a joint meeting of the two chapters on Jan. 13, at the Medinah Club, Chicago. Dr. Geo. B. Waterhouse, professor of metallurgy, Massachusetts Institute of Technology, and national president of the Society, was featured in an address on "Progress of Tool Steel."

Following dinner, a boxing match of five fast and furious rounds of Brown Bombing brought rollicking shouts of amusement from the audience.

Chairman E. Gammeter handled the introductory program by welcoming the Calumet Chapter and other guests.

### Calumet Has 165 Members

O. W. McMullan, secretary of the Calumet Chapter, outlined the reason for organizing a chapter in such close proximity to Chicago. He pointed out that out of a membership of 165, only 40 had transferred from the Chicago Chapter.

He issued a standing invitation to those present to attend the monthly meeting of his Chapter held at the Woodmar Country Club, Hammond, Ind. He also thanked the Chicago Chapter for including Calumet in their directory and year book.

Past Chairman R. G. Guthrie acted as technical chairman and introduced the speaker. His talk, which is abstracted elsewhere in this issue, was handled in a manner that could only be accomplished by Dr. Waterhouse.

In closing, the President indicated that the National Society was in excellent shape and commented on the phenomenal growth of the young Calumet Chapter.

As both types of electric furnaces as well as the crucible process are used in the Chicago district, a very lively and educational discussion followed Dr. Waterhouse's address. Remarks by such men as Dr. Davenport, Arthur Clarage and Bob Archer contributed very materially to the open discussion.

## Stresses Make Flow Of Metal in Drawing Difficult to Analyze

Winlock Speaks on Deep Drawing of Sheet and Strip

By H. P. Munger

Mahoning Valley Chapter—Because of the complex distribution of stresses, it is exceedingly difficult to analyze the probable flow of metal in drawing, said Joseph Winlock of Edward G. Budd Co., speaking on "Sheet and Strip Steel for Deep Drawing" in January.

In steel for a given draw it is necessary to have close cooperation between the mill men, the shop men, and the metallurgist in order to secure the desired stamping.

Sheet and strip are produced by either hot or cold rolling. To produce material suitable for deep draws, it is usually necessary either to normalize (heat above the  $A_3$  point) or box anneal (below the  $A_3$ ).

In box annealing, grain size is governed by the amount of cold reduction, time and temperature of the anneal. With 5 to 15% cold reduction critical grain growth will probably result. If the cold reduction is too high, and the annealing temperature too low, a fine-grained steel will result but it will be too tough, susceptible to buckling and stretcher strains during drawing, and will cause excessive wear on the dies.

The optimum grain size has been found to be about  $\frac{1}{8}$  in. in diameter at 100 magnifications.

When slip has taken place, certain parts of the steel work harden, forcing other parts to slip. If it were not for this work hardening, it would not be possible to make deep draws with steel.

### Cause of Stretcher Strains

Stretcher strains are irregular lines of depressions which result from the inherent property of low carbon steel to flow unevenly when being drawn through the yield point. They are eliminated by cold rolling a small amount, which results in partly slipping most of the planes which are easily deformed, thus preventing the uneven plastic flow at the yield point.

Some very interesting experimental work has been done in determining the relationship of rate of deformation in the tensile test to elongation at the yield point. This work has shown that as the rate of deformation is decreased, the yield point elongation decreases, and the tendency to stretcher strain also decreases.

The properties in the direction of rolling are better than across the direction of rolling. In laying out a stamping, advantage is taken of this fact and the most difficult part of the draw made in the rolling direction.

## Congress Lecturer



Dr. A. Allan Bates, Manager of Chemical and Metallurgical Research, Westinghouse Electric & Mfg. Co., Pittsburgh, Will Present a Five-Lecture Educational Course on "Fundamentals of Ferrous Metallurgy" Daily During the Week of the Western Metal Congress in Los Angeles March 21 to 25

## Baltimore Chairmen Honored at Meeting

By J. Arthur Reese

Baltimore Chapter began its January meeting by paying tribute to the past chairmen of the Chapter with the presentation of a deserving token for their untiring efforts in endeavoring to propagate the science of metallurgy.

The speaker of the evening was A. B. Kinzel, chief metallurgist, Union Carbide and Carbon Research Laboratory, Inc., New York, who spoke on "Mechanical Testing with Reference to Special Properties of Metals."

Dr. Kinzel began with a detailed description of the tensile test, defining the maximum strength as the highest load and the ultimate strength as the breaking load.

In impact testing some correlation between temperature, type of notch and velocity of the load may be made. A drop in temperature will not change the reduction of area greatly, but will cause a rapid drop in the impact value.

Dr. Kinzel emphasized repeatedly the great difficulty in verifying the results to be procured from service performances by translating the information obtained from accelerated laboratory tests, because of the impossibility of duplicating all of the conditions in actual service.

Following Dr. Kinzel's lecture, a sound motion picture entitled, "Precisely So," depicted some of the testing methods employed by the Chevrolet Motor Division of General Motors.

## Celebrities at Chicago Speakers' Table



Some of the Celebrities at the Speakers' Table, Chicago-Calumet Joint Meeting. Left to right: Past National Treasurer Claridge, President Waterhouse, Past-President Guthrie, Chicago Chairman Gammeter, and Trustee Anderson

## Metal of Weld Is Better Than Base or Rod

Shielded Electrode Improves Strength, Ductility, Impact and Corrosion, Lincoln Shows

By J. W. McBean

Ontario Chapter—Guest speaker at the bumper welding meeting on Jan. 7 was J. F. Lincoln, president of the Lincoln Electric Co.

Mr. Lincoln pointed out the importance of the shielded arc electrode which will deposit metal superior both to the base metal and to the metal of the rod itself. At the temperature of the arc and with ordinary rods the oxygen and nitrogen of the air form metallic oxide inclusions and hard and brittle nitrides.

In the coating of the shielded electrode one constituent, such as cellulose, gives off carbon monoxide and hydrogen to deoxidize the metal and make the joint clean and dense. Another constituent contains slag-forming materials such as titanium oxide and asbestos, which form a continuous protective coat over the hot, deposited metal that cracks off readily when cold.

### Welding Saves Weight and Cost

Slides showed that tensile strength of 55,000 psi. for a bare electrode was changed to 70,000 psi. with the shielded electrode. Reduction of area was better and a notched sample gave an Izod impact value of 81 ft-lb. Acid etch tests showed that both the deposited metal and the base metal were less attacked than when bare rods were used.

A large amount of arc welded work is replacing castings with a great advantage in cost, weight and other properties. Tensile strength of steel is nearly four times that of ordinary castings, modulus of elasticity and fatigue limit are more than twice as great, and ductility is immensely better. The saving in cost of patterns when only a few pieces are required is large.

### Adoption Delayed by Conservatism

Mr. Lincoln made it clear that welded steel cannot be expected to take the place of all castings, but showed some excellent examples. In a motor frame, not only was the cost reduced from \$52 to \$19, but the ventilating space was increased and the motor was cooled more efficiently.

One of the reasons for delay in adoption of welded structures is the fact that we have been used to the appearance of cast iron structures with rounded corners and flaring bases. This conception will change, however.

Another factor retarding development is that when we overcome our conservatism we have a tendency to go to extremes in adopting the new method. Best results can only be obtained by paying careful attention to design.

### Regulations Are Inconsistent

A considerable barrage of questions was met, and among the points cleared up was that stress relief at atmospheric temperature is often sufficient, but for heavy plates, say 1½ to 6 in. thick, heat must be used.

It was suggested that alternating current should be used for heavy plate, but in most cases direct current gives the best results.

Some of the striking inconsistencies of present regulations are found in the oil industry. The well casing must be riveted, while the pipe line at 800 psi. pressure must be welded. A still with 1000 psi. at 1000° F. must be welded, a gasoline tank car riveted, and a large storage tank welded.

## Flame Hardening Is Practical, Low-Cost And Widely Adaptable

By Ray P. Dunn

North West Chapter—The rather new method of surface hardening known as "flame hardening" was the subject of G. V. Slottman's address on Dec. 14. Mr. Slottman is assistant manager of the Applied Engineering Department of the Air Reduction Sales Co., New York.

Although the principle of this process is very old, its practical applications were not developed until recent years.

The wide adaptability, simplicity of equipment and operation, and relatively low cost of the flame hardening process make it quite practical in view of the excellent results obtained. It is particularly valuable for hardening gears, car stop rails, grooves in street car rail intersections, and other surfaces subject to wear.

A movie in color and numerous slides illustrated the process of gear tooth hardening and other applications.

Small pieces can be flame hardened by using a regular welding torch along with some quenching medium. Large pieces usually necessitate the use of special water-cooled tips designed for the work. These multi-flame tips have several rows of quenching jets on both sides of the heating jets in order to keep the heated area localized and controlled. The quenching medium can be a water spray, compressed air, or both.

The depth of case and composition of case can be closely controlled by varying the rate of travel of the torch, the size of the torch, the pressures of the oxygen and acetylene, the volumes of the two gases, the quenching medium and rate of quench.

Wide, flat pieces are flame hardened in strips; the quench jets protect the adjoining strip already heat treated from losing its properties. The distortion produced is generally negligible.

The speed of travel of the torch is about 6 in. per min., but it varies depending upon the thickness of the material and the desired depth of case.

## Continuous Mill Described

(Continued from page 1)

tine testing of sheet steel. The numerous factors that are revealed by the tensile test, particularly when stress-strain curves are available, were shown. The correlation between stretcher straining and amount of cold working was clearly shown by means of stress-strain curves and the recurrence of stretcher straining upon aging was also dealt with.

The moving pictures showed the various steps in the manufacturing of deep drawing sheets from the mining of the ore to the finished product, according to the continuous mill practice used by The American Rolling Mill Co. During the presentation of the film the places where present practice differs from the old sheet bar practice were pointed out.

## Low Alloys Developed for Strength, Easy Fabrication

By M. M. Kennedy

Philadelphia Chapter—On Dec. 3, A. B. Kinzel of Union Carbide and Carbon Research Laboratories spoke on the development in low alloy structural steels, brought about by the need for materials having high strength and ductility which are readily fabricated, particularly by welding. The main points of Dr. Kinzel's address have been covered in previous issues of THE REVIEW.

With his statements fresh in their

## 38 Questions Asked

### New Method of Conducting Seminar on Physics of Metals Produces Abundant Material

By David R. Howerton

The second of the series of metallurgical seminars offered by the Chicago Chapter was held Dec. 2.

The discussion on "The Physics of Metals" was handled a bit differently than had been previous seminar subjects and results were very successful.

Each attendant at the meeting handed in one written question relative to some phase of the subject in which he was most interested. Thus an abundant amount of material was obtained which was of particular interest to those who attended.

Preliminary introductory remarks by J. L. Burns, metallurgist, Chicago District, Republic Steel Corp., were followed by discussion of the written questions. This would have lasted for hours but Harvey Anderson, technical chairman, long known for his punctuality, closed the meeting on scheduled time.

The 38 questions submitted were comprehensive and enlightening. A list of them may be secured by any interested chapter upon request to the National Office. No responsibilities will be assumed by the Chicago Chapter, however, for the results of the discussion.

## New Milestone Set By Color Film on Mo High Speed Steel

By Merrill A. Scheil

Milwaukee Chapter—The December meeting was entirely in the able hands of A. W. F. Green, director of the Physical Testing Laboratory, Ludlum Steel Co., Watervliet, N. Y.

After a fine turkey dinner at the Milwaukee Athletic Club, the members and guests were entertained with a series of beautiful color movie films. The first color film was a record of a hunting trip taken in Alaska, which Mr. Green described in an intimate and lucid manner.

He then went on to tell about the newly developed molybdenum high speed steels and again surpassed anything the chapter has witnessed with his showing of the manufacture, heat treatment and use of these materials with color movie film.

Throughout his description of the manufacture and utilization of these new alloys, Mr. Green gave some very intimate glimpses into the metallurgy of this steel.

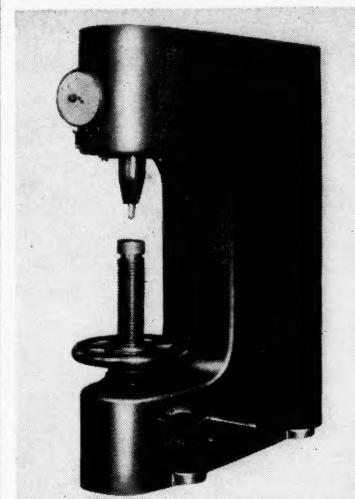
Heat treatment must be closely controlled both as to temperature and atmosphere, whether liquid or gaseous, to attain the desired results. Mr. Green emphasized this point particularly since it has caused considerable trouble in the past.

Mr. Green pointed out the different compositions now on the market, and cautioned against accepting these steels as a cure-all. The specific uses mentioned and illustrated had to do with machining tools such as planer and lathe tools, drills and reamers for the cutting of steel and cast iron.

minds, the Chapter members presented a timely discussion, and Dr. Kinzel responded freely as if he were once again a member of the Philadelphia Chapter. The whole was both interesting and enjoyable.

Previous to the meeting, Captain Leslie S. Fletcher of the Frankford Arsenal, an active member of the Chapter, gave a talk on modern ordnance.

## Hardness Tester



The Pyro-Electro Instrument Co., 6659 Chase Road, Dearborn, Mich., has developed a direct reading universal hardness testing machine which is calibrated for three balls, 1-16 in., 1-8 in., and 5 mm.; also for a penetrator diamond.

The load is applied by a hand operated crank conveniently located to the right of the operator and just below the elevating screw which eliminates lost motion and operator strain in reaching to the top of the machine.

The standard machine has a vertical capacity of 8 in.; load capacities of 60 kg., 100 kg., and 150 kg., with no change in minor load. Tests on very thin stock, say at 15 kg. or, conversely, at 750 kg., require a special type.

## Two Movies, Talk on High Speed Featured

By L. Geerts

Boston Chapter—The Jan. 7th meeting was no exception to the good attendance records and highly successful programs currently being featured.

Committee Chairman R. F. Harrington announced details of the educational course beginning Jan. 13. Special arrangements for student participation have been made.

A. W. F. Green, director of Physical Laboratory at Ludlum Steel Co., presented a movie entitled "Molybdenum in High Speed Steel," along with which he delivered a most interesting explanatory talk. The film and talk are reviewed elsewhere in this issue.

An added attraction was the showing of a colored hunting and fishing picture recently taken by H. G. Batcheller, president of Ludlum Steel Co., on a trip to Alaska.

## 612 Attend N.J. Smoker

By F. A. Pease

New Jersey Chapter concluded the year 1937 with a most successful smoker held at the Essex House, Newark, N. J., on Dec. 13.

Six hundred and twelve members and guests were present to dine, imbibe, and take away 112 prizes, presented by various industrial plants throughout Northern New Jersey.

Preceding the banquet, the members and guests were entertained in a most professional manner by magicians, story tellers, dancers, and impersonators.

Smoker Chairman C. J. Weigel and his committeemen, J. F. Wyzalek, A. M. McWilliams, and D. A. Butler, all contributed to make the second smoker such a great success that members and friends are looking forward to next year's celebration with a great deal of anticipation.

## Bearings Tested at High Loads and With Poor Lubrication

By N. L. Peck

Oregon Chapter—The regular meeting was called to order and Charles Simpson made a report on the activities of the newly appointed Educational Committee.

The first part of the regular program was ably handled by William Prier, a local member. His lecture on "Behavior of Certain Non-Ferrous Bearing Metals" was based upon a long series of experimental tests made at his plant, the Oregon Brass Works. The object of these tests was to study the behavior of different bearing metals when subjected to excessive loads and poor lubrication.

Mr. Prier started his talk by naming several requirements for a good bearing metal:

1. Sufficient plasticity to conform with the journal.
2. Ability to withstand continuous flexing.
3. Structure consisting of a soft matrix with hard spots.
4. Low coefficient of friction.
5. Hardness at operating temperatures.

He also mentioned the role that each element plays in the several common bearing metals. Nickel is used to hold lead in suspension, zinc as a flux, tin as hardener, copper as a base, phosphorus as a deoxidizer, and lead to reduce friction.

It was Mr. Prier's opinion that the greatest field for development lies in the direction of the copper-lead alloys; this is an ideal combination of elements but unfortunately offers serious foundry problems. His results indicated that a bearing with a Brinell hardness of 25 to 30 will stand all that liquid lubrication can carry.

A short intermission was then called while the motion picture equipment was made ready. C. T. Winter, northwest sales manager for the Republic Steel Corp., then showed a new motion picture on the production and use of stainless steel. The picture showed some of the reasons for the apparent high cost of this new commodity.

## Juniors Are Entertained

By H. D. Churchill

Cleveland Chapter—The third regular meeting, held Nov. 29, was set aside as Junior Members' Night, with the Chapter acting as host to its junior members for dinner. About 30 of the youngsters turned out.

The technical meeting was the annual non-ferrous session with Prof. Clair Upthegrove of the University of Michigan speaking on the subject of "Bronzes."

Prof. Upthegrove began with a brief historical discussion on the early use of bronzes and then continued with a detailed discussion of present-day practice in the production and use of these materials.

The talk was profusely illustrated with slides showing the various alloys in present-day use, their constitution and physical properties.

## Carburizing Book Authors

By an unfortunate oversight the names of three authors of papers in the Carburizing Symposium were omitted from the ad on page 98 of the January issue of METAL PROGRESS. They are L. D. Gable and E. S. Rowland, metallurgist and research metallurgist respectively, Timken Roller Bearing Co., and B. B. Beckwith, Metallurgical Department, Chrysler Corp.

## HERE AND THERE WITH A.S.M. MEMBERS

**F**EATED by the Crocker-Wheeler Foremen's Club was Secretary FRANK A. ELSHOFF of the New Jersey Chapter on the occasion of the completion of 25 years' service for Crocker-Wheeler Electric Mfg. Co.

Mr. Elshoff, who is works manager, was honored by a testimonial dinner given at the Essex House, Newark, on Feb. 1, at which he was presented

by the members of the Club with an engrossed resolution and a wrist watch.

Fifty-one years ago Mr. Elshoff's first job was to wire one of the first stores in the United States to be provided with electric light. Before joining Crocker-Wheeler he worked for Westinghouse and Allis-Chalmers.

F. A. Elshoff

**K**ARL L. FETTERS has resigned as secretary-treasurer of the Mahoning Valley Chapter in order to accept a research assistantship and a graduate scholarship at M. I. T.

Mr. Fetter, who graduated from Carnegie Tech in 1931 and has since been employed in the metallurgical departments of the National Tube Co. and the Youngstown Sheet and

Tube Co., will pursue work leading to a doctor of science degree in metallurgy.

JAMES A. SMAIL, Republic Steel Corp., has been appointed to succeed Mr. Fetter as secretary-treasurer.

K. L. Fetter



# Western Metal Congress—Technical Program

## American Society for Metals

### MONDAY MORNING, MARCH 21

*Tin Plate in the Canning Industry*—B. W. Gonser, Battelle Memorial Institute.

*Application of Metals in Chemical Industry*—F. L. LaQue, International Nickel Co.

*Fabrication and Application of Stainless Steels Containing up to and Including 16% Chromium*—Bradley Stoughton, Lehigh University.

*Fabrication and Application of Stainless Steels Containing 18% Chromium and Over*—V. N. Krivobok, Allegheny Steel Co.

### MONDAY AFTERNOON, MARCH 21

*Testing for Wear*—Fred Arnold, Kobe, Inc.  
*New Developments and Applications of Hard Facing Material*—C. C. Pendrell, Haynes-Stellite Co.

*High Tensile Structural Steels in Transportation*—A. F. Stuebing, U. S. Steel Corp.

### TUESDAY MORNING, MARCH 22

#### Petroleum Program

*Metals Used in Petroleum Production*—Harry W. McQuaid, Republic Steel Corp.

*Metals Used in Pipe Line and Pipe Line Station Construction*—L. F. Scherer, Texas Pipe Line Co.

*Theory and Practice in Pipe Protection*—Gordon N. Scott, Pipe Line Technologist.

*Valves for the Petroleum Industry*—George Sherer, Merco-Nordstrom Co.

### TUESDAY AFTERNOON, MARCH 22

#### Petroleum Program (cont.)

*General Application of Metals in Refining*—R. L. Wilson, Climax Molybdenum Co.

*High Temperature Characteristics as Revealed by Rupture Tests*—W. G. Hildorf, Timken Roller Bearing Co., A. E. White and C. L. Clark, University of Michigan.

*Typical Failures of Still Tubes in Refinery Service*—E. C. Wright, National Tube Co.

*Alloy Steel for Tubular Oil Heaters*—R. L. Wilson, Climax Molybdenum Co.

### WEDNESDAY MORNING, MARCH 23

#### Mining, Smelting and Refining Program

##### Simultaneous Session

*Metals Used in Production Mining Equipment*—G. B. Waterhouse, Massachusetts Institute of Technology.

*Metals Used in the Smelting and Refining Processes*—R. S. Dean, U.S. Bureau of Mines.

*Metals Used in the Dredging Process*—C. M. Romanowitz and Herbert A. Sawin, Yuba Manufacturing Co.

*A New Electro-Metallurgical Industry in the Pacific States*—R. S. Dean, U. S. Bureau of Mines.

#### Aeronautical Program

##### Simultaneous Session

*Metals in the Aircraft Industry*—J. R. Goldstein, Douglas Aircraft Co., Inc.

*Recent Developments in the Application of Magnesium Alloys to Aircraft*—Arthur W. Winston, Dow Chemical Co.

*Design and Production of Aluminum Alloy Aircraft Forgings*—A. A. Handler and L. W. Davis, Aluminum Co. of America.

*Engineering Alloy Steels (S.A.E. Specifications)*—Bradley Stoughton, Lehigh University.

### WEDNESDAY AFTERNOON, MARCH 23

#### Aeronautical Program (cont.)

*Steel Forgings for Aircraft*—Waldemar Naujoks, Steel Improvement & Forge Co.

**A**LL MORNING sessions will be held at 9:30 a.m. at the Biltmore Hotel; all afternoon sessions at 2:00 p.m. at the Pan-Pacific Auditorium. The course on "Fundamentals of Physical Metallurgy" will be presented every evening at 8:00 p.m. in the Pan-Pacific Auditorium with the exception of Thursday, when the time will be 5:00 p.m.

*Stainless Steel for Aircraft*—Carl de Ganahl, Fleetwings, Inc.

*X-Ray Inspection of Aeronautical Materials*—Tom A. Triplett, Triplett & Barton Labs.

*Aluminum in Diesel Engines*—P. B. Jackson, Aluminum Co. of America.

### THURSDAY MORNING, MARCH 24

*Economic Phase of the Metal Industry in the West*—A. N. Diehl, Columbia Steel Co.

*Carbon and Low Alloy Tool Steels*—J. P. Gill, Vanadium-Alloys Steel Corp.

*High Speed and High Alloy Tool Steels*—J. P. Gill, Vanadium-Alloys Steel Corp.

*Controlled Furnace Atmospheres*—E. E. Thum, Editor, Metal Progress.

*Hardenability as It Affects Heat Treated Parts*—M. A. Grossmann, Carnegie-Illinois Steel Corp.

### THURSDAY AFTERNOON, MARCH 24

#### Machinability Program

*Machinability, Especially of the Steel "Screw Stocks"*—J. D. Armour, Union Drawn Steel Co.

*Machinability of Alloy Steels*—Harry W. McQuaid, Republic Steel Corp.

*Machinability of All Types of Castings, Including Malleable, Gray Iron and Steel*—E. K. Smith, Electro Metallurgical Co.

*Machining of Cast and Wrought Aluminum Alloys*—W. A. Dean, Aluminum Co. of America.

### THURSDAY EVENING, MARCH 24

#### Dinner—Dance—Entertainment

All cooperating societies of Western Metal Congress and the exhibitors of the Western Metal Exposition will join in a dinner dance at the Biltmore Bowl and will have as their guests many of the outstanding stars of Movieland and Hollywood.

### FRIDAY MORNING, MARCH 25

#### Foundry Program

*All foundry papers will contain information on (1) new technique for castings and (2) new advances in the uses of castings*

*Improvements in Steel Castings by Moderate Alloying and Heat Treatment*—F. A. Melmoth, Detroit Steel Casting Co.

*Nickel Steels and Irons*—F. J. Walls and T. N. Armstrong, International Nickel Co.

*High Chromium Steels and Irons*—E. K. Smith, Electro Metallurgical Co.

*Molybdenum Steels and Irons*—W. P. Woodside, Climax Molybdenum Co.

### FRIDAY AFTERNOON, MARCH 25

#### Foundry Program (cont.)

*Flame Hardening*—G. V. Slottman, Air Reduction Sales Co.

*Copper Alloys*—William Romanoff and C. O. Thieme, H. Kramer & Co.

*Aluminum Castings*—H. J. Rowe, Aluminum Co. of America.

*Die Castings*—W. W. Broughton, New Jersey Zinc Sales Co.

## A. S. M. E. Spring Meeting

### WEDNESDAY MORNING, MARCH 23

#### Hydraulics

*Centrifugal Pumps for the Colorado Aqueduct*—R. L. Daugherty, California Institute of Technology.

*Cavitation of Centrifugal Pumps*—George F. Wislicenus, Ralph M. Watson and I. J. Karassik, Worthington Pump and Machinery Co.

#### Petroleum

*Problems in Modern Deep-Well Drilling*—Robert L. Keyes, The Texas Co.

*Problems in Modern Deep-Well Pumping*—C. J. Coberly, Kobe, Inc.

#### Process Industries

*Pressure Pipe Thermometer Systems*—L. G. Beam and A. Noble, Bristol Co.

*Pyrometers*—R. L. Goetzenberger and W. A. Rolnick, Brown Instrument Co.

### WEDNESDAY EVENING, MARCH 23

#### Hydraulics

*Erosion of Impulse Wheel Nozzles*—Professor Tenot of France.

*Modern Turbine Governing*—E. E. Woodward, Woodward Governor Co.

#### Petroleum

*Design of Transmission Systems for Heavy Oil*—Fritz Karge, Union Oil Co. of California.

*Modern Combustion Furnaces*—Albert L. Baker, M. W. Kellogg Co.

#### Management

*Paper by A. C. Galbraith*, Union Oil Co. of California.

*Scientific Management in the Light of Present-Day Conditions*—King Hathaway, Consulting Engineer.

#### Miscellaneous

*System Frequency Change from 50 to 60 Cycles*—C. O. West, Bureau of Power & Light, City of Los Angeles.

*Heat Transfer Research at University of California*—L. M. K. Boelter, University of California.

### THURSDAY MORNING, MARCH 24

#### Hydraulics

*Kaplan Turbines at Bonneville*—P. L. Heslop, War Department, and Mr. Jessup, S. Morgan Smith Co.

*Spillway Gates at Bonneville*—E. R. Miller, T.V.A.

#### Fuels

*The Technique of Burning Fuel Oil and Natural Gas*—F. G. Philo, Southern California Edison Co.

*Combination Oil and Gas Burners*—O. F. Campbell, Sinclair Refining Co.

#### Aeronautics

*The Hydraulic Press at Douglas*—Henry E. Guerin, Douglas Aircraft Co., Inc.

*Dynamic Correlations Between Vehicle and Superstructures*—R. K. Bernhard.

*Maximum Economy in Air Transportation*—Charles McLellan.

### FRIDAY MORNING, MARCH 25

#### Hydraulics

*Deep-Well Pump Testing Laboratory at the University of California*—R. G. Folsom, University of California.

*Hydraulic Jump in Slope Channels*—B. A. Bakhtmetff and A. E. Matzke, Columbia University.

#### Applied Mechanics

*A New Relationship for Use in Design of Machine Columns*—W. H. Clapp, California Institute of Technology.

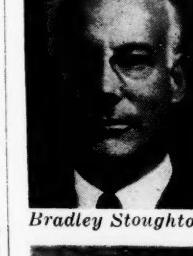
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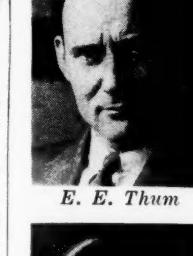
G. B. Waterhouse



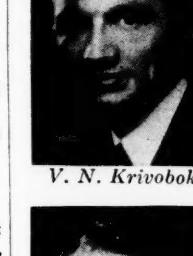
W. P. Woodside



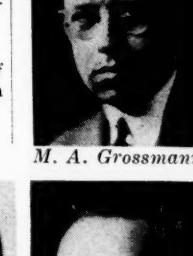
Bradley Stoughton



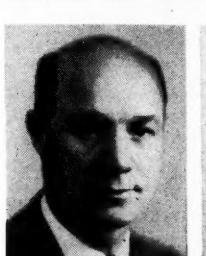
E. E. Thum



V. N. Krivobok



M. A. Grossmann



J. D. Armour



A. F. Stuebing



Wm. Romanoff



C. O. Thieme



J. R. Goldstein



W. W. Broughton



G. N. Scott



G. V. Slottman

A Few of the Authors of Western Metal Congress Papers

## Program for Western Metal Congress

(Continued from page 7)

**Fluid Problems of Ocean Circulation**—H. U. Sverdrup, Scripps Institute of Oceanography.

### Miscellaneous

**Mechanical Problems in Design of Diesel Tractors**—C. G. A. Rosen, Caterpillar Tractor Co.

**Mechanical Problems of the 200-Inch Telescope**—Michael Karelitz, California Institute of Technology.

### American Welding Society

MONDAY MORNING, MARCH 21

**Symposium on Welded Oil Well Casing Strings**

**Weldability and Properties of Materials for Casing Strings**—J. C. Hodge and L. H. Sadler, Babcock & Wilcox.

**Field Practice in Welding Casing Strings**—Howard Newby, American Pipe & Steel Corp.

**Physical and Economical Advantages of Welded Casing Strings**.

TUESDAY MORNING, MARCH 22

**Application and Proper Use of Hard Facing Materials**—Don Llewellyn, Air Reduction Sales Co.

**Welding Cast Irons**—Gilbert S. Schaller, University of Washington.

**Helping the Small Job Shop Welder**—J. C. Gowing, J. C. Gowing Co.

**Welded Plate Construction for Machinery Bases and Substructures**—Richard Young, Bethlehem Steel Corp.

WEDNESDAY MORNING, MARCH 23

**Symposium on Large Welded Pipe for Water & Power Transmission**

**Problems Connected with the Pre-**

**paration of a Standard Code for the Construction of Large Welded Pipe**—W. F. Durand, Stanford University.

**Shop Fabrication of Large Diameter Steel Pipe**—L. M. Muffler, Consolidated Steel Corp.

**Mitigation of Corrosion in Steel Pipe Lines of the Colorado River Aqueduct**

**H. P. Vail, Metropolitan Water District of Southern California.**

THURSDAY MORNING, MARCH 24

**Design and Fabrication of High Temperature and High Pressure Piping**

**F. C. Fantz, Midwest Piping and Supply Co.**

**Recognizing and Repairing Weaknesses in Existing Pressure Vessels**—K. V. King and F. T. Patton, Standard Oil Co. of Calif.

**Stainless Alloy Welded Plate and Castings in Corrosion Resisting Pressure Equipment**—Randolph Simpson, Electric Steel Foundry Co.

**The Effect of Alloy Additions Upon the Welding Properties of the Chromium Steels**—Leon C. Bibber, Carnegie-Illinois Steel Corp.

FRIDAY MORNING, MARCH 25

**Design of Welded Connections in Building Construction**—Paul Jeffers, Consulting Structural Engineer.

**Resistance Welding Processes and Their Application**—Stanley Levyn, Acme Electric Welder Co.

**Problems in Welding Light Gage Materials**—J. J. Bruton, Linde Air Products Co.

**Spot Welding Aircraft Materials**—C. L. Hibert, Consolidated Aircraft Corp.

## CHAPTER CALENDAR

### MARCH

CHAPTER	DATE	PLACE	SPEAKER	SUBJECT
Baltimore	Mar. 7	Engineers Club	G. D. Welty	Aeronautic Materials
Boston	Mar. 4	Mass. Inst. of Tech. Room 1-390	A. D. Bach	Commercial Heat Treatment of Steel
Buffalo	Mar. 10	Woodmar Country Club		Titanium
Calumet	Mar. 8	Hammond, Ind.	A. M. Steever	Manufacture of Steel Forgings
Canton-Mass.	Mar. 17	Hotel Onesto	V. N. Krivobok	Stainless Steels
Chicago	Mar. 10	Medinah Club	A. Kinzel	Effects of Alloying Additions in Steel Making
Cincinnati	Mar. 10	Alms Hotel	D. P. Forbes	Developments in Cast Iron
Cleveland	Mar. 7	Cleveland Club	H. C. Richardson	Historical Steel Making
Columbus	Mar. 8		D. P. Forbes	Developments in Cast Iron
Dayton	Mar. 9	Engineers Club	D. P. Forbes	Developments in Cast Iron
Detroit	Mar. 14		W. E. Benninghoff	Induction Hardening
Hartford	Mar. 8	Hartford Gas Co.	C. Upthegrove	Non-Ferrous Age Hardening
Indianapolis	Mar. 21	Hoosier Athletic Club	H. L. Day	Heat Treatments
Lehigh Valley	Mar. 25	Hotel Taylor, Allentown, Pa.	E. F. Davis	Gears and Carburizing
Mahoning Valley	Mar. 14	Tod Hotel	O. W. Boston	Machinability
Milwaukee	Mar. 23	Milwaukee Athletic Club		Modern Bronzes
Montreal	Mar. 7	Windsor Hotel		High Frequency Induction Furnaces
New Haven	Mar. 17	Hammond Laboratory, Yale University	A. H. d'Arcambal	Factors Affecting Machinability
New Jersey	Mar. 14	Essex House, Newark	J. R. Vilella	Grain Size and Grain Growth
New York	Mar. 14	Building Trades Employers Association Club		
North West	Mar. 8	Minnesota Union, Uni- versity of Minnesota	E. R. Darby	Bearing Metal Alloys
Notre Dame	Mar. 9	Engineering Auditorium, University of Notre Dame	J. D. Corfield	Wear Resistant Alloy Castings
Ontario	Mar. 17	Toronto	C. O. Thieme and G. P. Halliwell	Manganese Bronze
Oregon	Mar. 4	Lloyd's Club House	A. E. Cartwright	Selection and Production of Some Cast Non-Ferrous Alloys
Peoria	Mar. 14	Caterpillar Tractor Show Room Theater	V. M. Whitmer	Stainless Steels
Philadelphia	Mar. 25	Engineers Club	Fred Walls	Alloy Cast Iron & Foundry Practices
Pittsburgh	Mar. 20	Roosevelt Hotel	J. J. Crowe	Influence of Flame Upon Steel
Puget Sound	Mar. 9	Engineers Club	E. V. Crane	Power Presses and Metal Working Operations
Rhode Island	Mar. 2	Engineering Society Bldg.	Virgil Whitmer	
Rochester	Mar. 14	University of Rochester	C. H. Bierbaum	Bearings
Rockford	Mar. 10	Elks Club	C. C. Brinton	Welded Structures
Saginaw Valley	Mar. 15	Hotel Bancroft, Saginaw, Mich.	E. R. Young	Ferrous Castings
Schenectady	Mar. 15	Van Curler Hotel	W. E. Benninghoff	Induction Hardening
Southern Tier	Mar. 28	Jenkins Inn, Waverly, N. Y.	J. L. Cannon	Gas Carburizing
Springfield	Mar.		R. M. Burns	Corrosion Protection
Syracuse	Mar. 15	Onondaga Hotel	Mr. Kennedy	Electrodeposits
Texas	Mar. 4		D. K. Crampton	Non-Ferrous Metals
Tri-City	Mar. 28	Rock Island Arsenal	G. B. Waterhouse	Dance
Washington	Mar. 8	Garden House, Dodge Hotel	A. W. F. Green	The Saga of Fine Steel
Worcester	Mar. 3	Sanford Riley Hall, Worcester Polytechnic Inst.	Sam Tour	Die Casting
York	Mar. 16	York	C. M. Loeb, Jr.	Molybdenum

### APRIL

Baltimore	Apr. 4	Engineers Club		Tool Steels
Boston	Apr. 1		G. B. Waterhouse	Joint Meeting With Ontario
Buffalo	Apr. 15			
Calumet	Apr. 12	Woodmar Country Club, Hammond, Ind.	H. F. Moore	Physical Testing of Metals
Canton-Mass.	Apr. 15	Hotel Onesto	Quinn Tamm	Operations of Federal Bureau
Chicago	Apr. 14	Medinah Club	G. C. Riegel	Inspection of Steel and Cast Iron
Cincinnati	Apr. 14	Alms Hotel	R. G. Guthrie	Carburizing
Cleveland	Apr. 4	Cleveland Club	S. L. Hoyt	Metallurgical Laboratory Practices
Columbus	Apr. 12		R. G. Guthrie	Carburizing
Dayton	Apr. 13	Engineers Club	R. G. Guthrie	Carburizing
Detroit	Apr. 27		C. H. Herty, Jr.	Corrosion (Tri-Chapter Meeting)
Hartford	Apr. 11	Hartford Electric Light Co. Auditorium	W. A. Wesley	Progress in Steel Making
Indianapolis	Apr. 18		A. E. Krogh	Plating and Corrosion Resistant Coatings
Lehigh Valley	Apr. 22			
Los Angeles	Apr. 14	Southern Calif. Edison Co. Auditorium	Alex L. Robb	Materials Used in Diesel Engines
Mahoning Valley	Apr. 11	Tod Hotel	Jerome Strauss	Vanadium as an Alloying Element
Milwaukee	Apr. 19	Milwaukee Athletic Club	V. O. Homerberg	Nitriding
Montreal	Apr. 4		J. A. Durr	Manufacture and Uses of Steel Strip
New Haven	Apr. 21	Seven Gables Inn, Mil- ford, Conn.	H. W. Gillett	Furnace Atmosphere Control
New Jersey	Apr. 11	Essex House, Newark	I. I. Sikorsky	Aircraft of the Near Future
New York	Apr. 11	Building Trades Employers Association Club	W. E. Benninghoff	Differential Hardening by Induction
North West	Apr. 12	Minnesota Union, Uni- versity of Minnesota		
Notre Dame	Apr. 13	Engineering Auditorium, University of Notre Dame	K. R. Van Horn	Industrial Applications of X-Rays
Ontario	Apr. 1	Hamilton, Ont.	A. A. Bates	
Oregon	Apr. 7	Lloyd's Club House	W. P. Woodside	History of Alloy Steels
Peoria	Apr. 11	Pere Marquette Hotel	G. B. Waterhouse	
Philadelphia	Apr. 29	Engineers Club	K. R. Van Horn	Recent Advances in Non-Ferrous Alloys
Pittsburgh	Apr. 14	Roosevelt Hotel	W. H. Swanger	Service Failures of Metals
Rhode Island	Apr. 6	Engineering Society Bldg.	A. J. Morse	Cutting Tools
Rochester	Apr. 11	University of Rochester	J. P. Gill	Tool Steels
Rockford	Apr. 12	Elks Club	G. B. Waterhouse	
Saginaw Valley	Apr. 19	Durant Hotel, Flint, Mich.	D. L. Gibb	Plastics
Schenectady	Apr. 19	Rensselaer Polytechnic Institute, Troy, N. Y.	A. W. F. Green	
Southern Tier	Apr. 23	Cornell University, Ithaca, N. Y.	John Johnston	Progress in Study of Steel (Tri-Chapter Meeting)
Springfield	Apr.		S. Horn	Temperature Control Instruments
Syracuse	Apr. 12	Ithaca, N. Y.		Joint Meeting with Southern Tier
Texas	Apr.		C. F. Lewis	Physical Testing
Tri-City	Apr. 12	Rock Island Arsenal	G. B. Waterhouse	National Officers Night
Washington	Apr. 11	Garden House, Dodge Hotel	H. D. Robb	Roller Bearings
Worcester	Apr. 6	Sanford Riley Hall, Worcester Polytechnic Institute	H. H. Harris	Heat Resisting Alloys
York	Apr. 20	Harrisburg, Pa.	T. Holland Nelson	

## A Symbol of Your Membership

**Y**OUR SOCIETY is now more than 10,000 strong—an important, progressive force in the metal industry. Your participation in this progress—your membership in the —can now be symbolized with a handsome steel-engraved certificate with your name engraved thereon. Certificates are available in two sizes in either a black and gilt or stainless steel frame. Fill in the coupon, enclose check or money order, and mail to:

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